Claims:

1. An autocorrelator apparatus for measuring the distance from which light is reflected including:

a broadband light source for producing a first light beam;

a fiber light probe connected to receive the first light beam and shine it on a structure that reflects at least a portion of the first light beam as a second light beam into said fiber light probe;

a first optical fiber;

a second optical fiber, said second optical fiber having the near identical light path length as said first optical fiber;

first fiber means for splitting the second light beam into third and fourth light beams into said first and second optical fibers respectively;

a first fiber stretcher to vary the optical path length of said first optical fiber;

a first reflector positioned to reflect the third light beam back though said first optical fiber and said first fiber stretcher as a fifth light beam;

a second reflector positioned to reflect the fourth light beam back though said second optical fiber as a sixth light beam, said first fiber means combining the fifth and sixth light beams into a seventh light beam; and

a first optical receiver positioned to receive intensity variations in the seventh light beam and a signal representative of the variation in light path length of said first optical fiber and to produce therefrom indications of the displacement of reflections of the first light beam from said fiber light probe.

2. The autocorrelator apparatus as defined in claim 1 further including:

a second fiber stretcher to vary the optical path length of said second optical fiber opposite from the variation of the optical path length of said first optical fiber.

3. The autocorrelator apparatus as defined in claim 1 wherein said first fiber means include:

a single mode fiber coupler, and wherein said first and second fibers are single mode fibers.

4. The autocorrelator apparatus as defined in claim 1 wherein said first fiber means include:

a fiber coupler.

5. The autocorrelator apparatus as defined in claim 1 wherein said first fiber means include:

a single mode fiber coupler, wherein said first and second fibers are single mode fibers, and wherein said first and second reflectors are Faraday rotator mirrors.

6. The autocorrelator apparatus as defined in claim 1 further including:

a coherent light source for producing an eighth light beam of a wavelength frequency different from the first light beam;

means to couple the eighth light beam into said first and second optical fibers so that said first and second reflectors reflect ninth and tenth light beams therefrom which are combined at said first fiber means into an eleventh light beam;

a second optical receiver positioned to detect fringe variations of the eleventh light beam to determine the exact displacement of the scan of the first fiber stretcher at all points in its sweep.

7. The autocorrelator apparatus as defined in claim 6 further including:

a wavelength sensitive device connected to said first fiber means to direct the seventh light beam to said first optical

receiver and the eleventh light beam to said second optical receiver.

8. The autocorrelator apparatus as defined in claim 2 further including:

a coherent light source for producing a eighth light beam of a wavelength different from the first light beam;

means to couple the eighth light beam into said first and second optical fibers so that said first and second reflectors reflect ninth and tenth light beams therefrom which are combined at said first fiber means into an eleventh light beam;

a second optical receiver positioned to detect fringe variations of the eleventh light beam to determine the exact displacement of the scan of said first fiber stretcher at all points in its sweep.

9. The autocorrelator apparatus as defined in claim 8 further including:

a wavelength sensitive device connected to said first fiber means to direct the seventh light beam to said first optical receiver and the eleventh light beam to said second optical receiver.

10. An apparatus for measuring the distance from which light is reflected including:

a broadband light source for producing a first light beam;

a first fiber light probe connected to receive the first light beam and shine it on a structure that reflects at least a portion of the first light beam as a second light beam into said fiber light probe;

a first fiber stretcher through which the second light beam is passed back and forth to controllably modulate the second light beam; and

a first optical receiver positioned to receive intensity variations in the modulated second light beam and a signal representative of the variation in light path length of said first optical fiber and to produce therefrom indications of the displacement of reflections of the first light beam from said fiber light probe.

11. The apparatus as defined in claim 10 further including:

a second fiber stretcher through which the second light beam is passed back and forth to controllably modulate the second light beam opposite from the first light beam.

12. The apparatus as defined in claim 11 further including:

a polarizer through which the first light beam is passed for establishing a polarization thereof; and

polarization preserving optical fiber through which the polarized first light beam and the second light beam are passed.

13. The apparatus as defined in claim 10 further including:

a first Faraday rotator mirror positioned to reflect the second light beam back though said first fiber stretcher.

14. The apparatus as defined in claim 11 further including:
further including:

a first Faraday reflector positioned to reflect the second light beam back though said first fiber stretcher; and

a second Faraday reflector positioned to reflect the second light beam back though said second fiber stretcher.

15. An autocorrelator apparatus for measuring the distance from which light is reflected including:

a broadband light source for producing a first light beam;

a fiber light probe connected to receive the first light beam and shine it on a structure that reflects at least a portion of the first light beam as a second light beam into said fiber light probe;

a first optical fiber;

a second optical fiber, said second optical fiber having the near identical light path length as said first optical fiber;

first fiber coupler for splitting the second light beam into third and fourth light beams into said first and second optical fibers respectively;

a first fiber stretcher to vary the optical path length of said first optical fiber;

a first reflector positioned to reflect the third light beam back though said first optical fiber and said first fiber stretcher as a fifth light beam;

a second fiber stretcher to vary the optical path length of said second optical fiber;

a second reflector positioned to reflect the fourth light beam back though said second optical fiber and said second fiber stretcher as a sixth light beam, said first fiber means combining the fifth and sixth light beams into a seventh light beam; and

a first optical receiver positioned to receive intensity variations in the seventh light beam and to produce therefrom indications of the displacement of reflections of the first light beam from said fiber light probe.

16. The autocorrelator apparatus as defined in claim 15 wherein said first fiber means include:

a single mode fiber coupler, and wherein said first and second fibers are single mode fibers.

17. The autocorrelator apparatus as defined in claim 15 wherein said first fiber means include:

a single mode fiber coupler, wherein said first and second fibers are single mode fibers, and wherein said first and second reflectors are Faraday reflectors.

18. The autocorrelator apparatus as defined in claim 15 further including:

a coherent light source for producing an eighth light beam of a wavelength different from the first light beam;

means to couple the eighth light beam into said first and second optical fibers so that said first and second reflectors reflect ninth and tenth light beams therefrom which are combined at said first fiber means into an eleventh light beam;

a second optical receiver positioned to detect fringe variations of the eleventh light beam to determine the exact displacement of the combined scan of said first and second fiber stretchers at all points in their combined sweep.

19. The autocorrelator apparatus as defined in claim 18 further including:

a wavelength sensitive device connected to said first fiber means to direct the seventh light beam to said first optical receiver and the eleventh light beam to said second optical receiver.

20. The autocorrelator apparatus as defined in claim 17 further including:

a coherent light source for producing an eighth light beam of a wavelength different from the first light beam;

means to couple the eighth light beam into said first and second optical fibers so that said first and second reflectors reflect ninth and tenth light beams therefrom which are combined at said first fiber means into an eleventh light beam;

a second optical receiver positioned to detect fringe variations of the eleventh light beam to determine the exact

displacement of the combined scan of said first and second fiber stretchers at all points in their combined sweep.